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A new raninid crab (Crustacea: Decapoda: Brachyura) from the Kase Formation (lower Miocene) of Kyushu, Japan

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Abstract.—*Carinaranina fudoujii*, new species, a crab of the family Raninidae is described from the lower Miocene Kase Formation in Nagasaki Prefecture, Kyushu, southwest Japan. Recognition of this species of *Carinaranina* from the Miocene of Japan expands the geographic and geologic ranges of the genus, previously known from the Eocene–Oligocene of the Pacific slope of the U.S.A.

Tucker (1998) established the genus *Carinaranina* Tucker (1998) within the family Raninidae De Haan, 1841 and referred five species from Eocene–Oligocene rocks of Washington and Oregon to it. She also suggested using cladistic analysis that *Carinaranina* had close affinities with extant *Raninoides* H. Milne Edwards, 1837 and extinct *Laeviranina* Lörenthey *in* Lörenthey & Beurlen, 1929.

The purpose of the present paper is to describe a new species of *Carinaranina* from the Miocene of Japan. The specimens were collected from shale of the Kase Formation exposed in a cliff about 1.2 km east of Motogaura (Loc. KS-1), Shikano-cho, Kitamatsu-ura-gun, Nagasaki Prefecture (33°16′28″N; 129°37′03″E) (Fig. 1). *Carinaranina* occurred in the deposits, in association with a pelecypod, *Portlandia watasei* (Kanehara, 1937), and decapods, *Carcinoplax antiqua* (Ristori, 1889), and *Minohellenus* sp. The presence of planktonic foraminifera indicates that the geologic age of the Kase Formation was the earliest Miocene (24.5 Ma and 22.4 Ma) (Sakai et al. 1990).

Specimens are deposited in the Mizunami Fossil Museum (MFM), Yamanouchi, Akeyo, Mizunami, Gifu, Japan, and the Kitakyushu Museum and Institute of Natural History (KMNH IvP), Nishihonmachi 3-chome, Yahatahigashi-ku, Kitakyushu, Japan.

Systematics

Family Raninidae De Haan, 1841
Subfamily Raninoidinae Lörenthey *in* Lörenthey & Beurlen, 1929
Genus *Carinaranina* Tucker, 1998

Type species.—*Eumorphocorystes naselensis* Rathbun, 1926 by original designation.

Geologic range.—Upper Eocene–lower Miocene.

Carinaranina fudoujii, new species
Figs. 2, 3

Types.—MFM83061, holotype; 7 paratypes, MFM83062–83065, KMNH IvP 300,024–300,026.

Diagnosis.—Large sized *Carinaranina*. Carapace longitudinally ovate in outline, length about 1.4 times width, widest almost at midlength. Orbitofrontal margin narrow. Rostrum triangular, convex dorsally. Upper orbital margin with 2 V-shaped fissures. Outer orbital tooth wide, bifid; internal branch triangular; external branch broad without supplementary spine. Inner orbital tooth small. Anterolateral margin slightly concave. Hepatic spine slender, about 12% carapace length. Posterolateral margin weakly sigmoid. Dorsal surface gently convex, finely punctuate, with median carina. Chelipeds slender, elongate; dactylus and

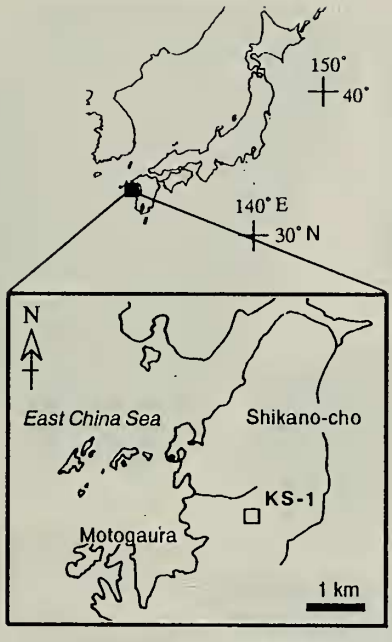

Fig. 1. Locality map.

propodus finely tuberculate; dactylus with granulated ridge on dorsal margin; propodus long, somewhat spinose on ventral margin; merus long. Dactylus of pereiopod 2 lanceolate.

Description.—Carapace (Figs. 2.1, 2.3, 2.6b, 2.8, 3.1) large for *Carinaranina*, longitudinally ovate in outline, length about 1.4 times width excluding hepatic spine, widest almost at midlength. Orbitofrontal margin occupying about 0.6 carapace width. Rostrum triangular, convex dorsally, with straight, beaded margins. Upper orbital margin marked by 2 open fissures; inner fissure V-shaped, directed longitudinally; outer fissure also V-shaped, slightly shallower than inner, approximately parallel to lateral margin of external branch of outer orbital tooth. Outer orbital tooth wide, bifid, margins finely granulate; internal branch triangular, longer than external branch but not shorter than rostrum; external branch broad, triangular, without supplementary spine. Inner orbital tooth small, triangular, directed anterolaterally. Anterolateral margin slightly concave; hepatic spine slender, directed anterolaterally, about 12% carapace length. Posterolateral margin weakly sigmoid, tapering posteriorly, with beaded marginal rim. Posterior margin slightly concave, about half carapace width. Dorsal surface gently convex longitudinally and transversely, medially keeled, finely punctuate except for marginal part of hepatic and epibranchial regions which are covered with fine granules. Dorsal regions poorly defined; only shallow, arcuate branchiocardiac grooves visible. Pterygostomian regions (Fig. 2.7) finely punctated ventrally.

Thoracic sternum (Figs. 2.2, 2.7, 3.2) narrow, elongate, fused through sternites 1–6, with smooth surface; sternites 1–3 separated from sternite 4 by slight emargination; lateral margins of sternite 4 concave, slightly tapering posteriorly; processes between somites 4 and 5 forming widest part of sternum; lateral margins of sternite 5 converging posteriorly; sternite 6 narrower than 5.

Chelipeds (Figs. 2.5a–c, 2.6a–b, 2.8a–b) slender, elongate; dactylus short, about as long as fixed finger, finely tuberculate on lateral and mesial surfaces, bearing granulated, dorsal ridges; propodus long, ovate in cross section, ornamented with fine, irregular tubercles on surfaces, somewhat spinose on ventral margin; fixed finger deflexed ventrally, occupying about 0.25 propodus length; carpus about 0.5 propodus length, cylindrical in cross section, finely granulate on surfaces; merus long, cylindrical in cross section, about equal to propodus length, surfaces covered with fine granules.

Propodus and dactylus of pereiopod 2 (Fig. 2.4) lamellate; propodus short, ovoid in lateral view; dactylus lanceolate, keeled medially.

Ischium and merus of maxilliped 3 (Fig. 2.7), long, slender.

Etymology.—The specific name honors Yasuhiro Fudouji, Karatsu, Saga, Japan, who collected the type specimens.

Remarks.—*Carinaranina fudoujii* is most similar to *Carinaranina naselensis* (Rathbun, 1926) from the Oligocene of

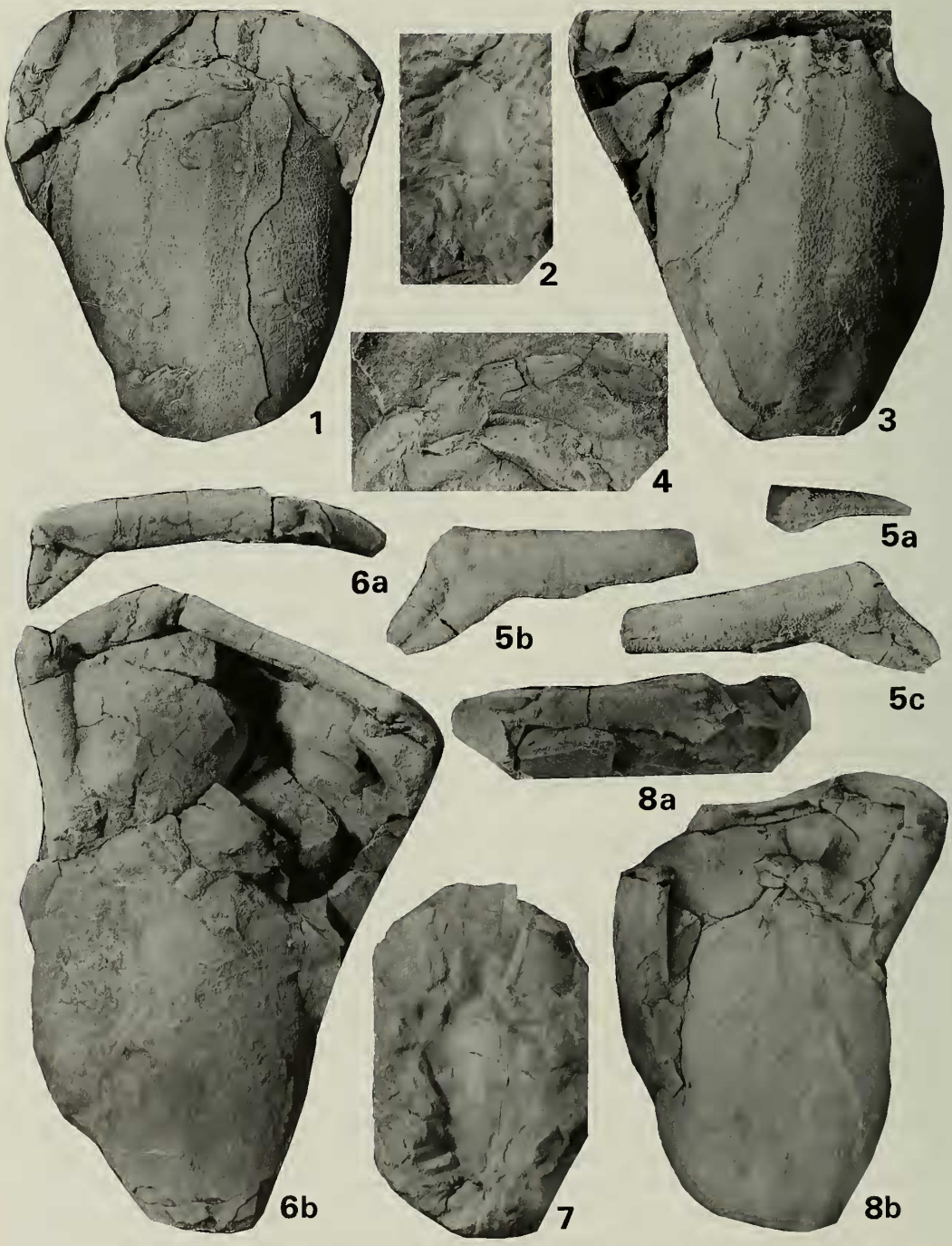

Fig. 2. *Carinaranina fudoujii*, new species: 1, KMNH IvP 300,024 (paratype), carapace and chelipeds, ×1.2, dorsal view; 2, KMNH IvP 300,025 (paratype), thoracic sterna, ×1.2, ventral view; 3, MFM83061 (holotype), carapace and cheliped, ×1.5, dorsal view; 4. MFM83062 (paratype), pereiopods 2, ×1.2, lateral view; 5a–c, MFM83063 (paratype), right cheliped, ×1.2, a, dorsal view of dactylus; b, mesial view; c, lateral view; 6a, b, KMNH IvP 300,026 (paratype), carapace and chelipeds, ×1.2, a, lateral view of left cheliped; b, dorsal view; 7, MFM83064 (paratype), thoracic sterna and maxillipeds 3, ×1.5, ventral view; 8a, b, MFM83065 (paratype), carapace and chelipeds, ×1.2, a, lateral view of right cheliped; b, dorsal view.

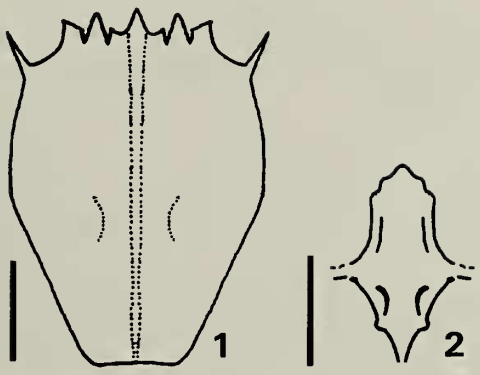

Fig. 3. Reconstruction of *Carinaranina fudoujii*, new species: 1, carapace, dorsal view; 2, thoracic sternites 1–6, ventral view. Scale bar equals 1 cm.

Washington, the type species of the genus, but differs in having a wider orbitofrontal region with two V-shaped open fissures on the upper orbital margin; a large, triangular internal branch of the outer orbital tooth; and a pair of slender, anterolaterally directed hepatic spines. The present new species differs from *Carinaranina willapensis* (Rathbun, 1926) from the Eocene Hoko River Formation of Washington by having a small inner orbital tooth, a broad external branch of the outer orbital tooth without a supplementary spine, and a pair of short hepatic spines. *Carinaranina fudoujii* is distinguished from *Carinaranina schencki* (Rathbun, 1932) from the Eocene Keasey Formation of Oregon by having a wide orbitofrontal margin. Two V-shaped fissures on the upper orbital margin and a short, slender hepatic spine readily distinguishes the present species from *Carinaranina marionae* Tucker, 1998 from the Eocene Hoko River Formation of Washington. From *Carinaranina leucosiae* (Rathbun, 1932) from the Eocene Keasey Formation of Oregon, *C. fudoujii* differs in that the latter exhibits a transversely ovate carapace and lacks spines on the dorsal margin of the propodus of the cheliped.

Hitherto, known members of *Carinaranina* have been recorded from the Eocene–Oligocene of Washington and Oregon (Tucker, 1998). The discovery of the new species extends the geologic range for the genus from the Oligocene to the early Miocene and the geographic range from the east side of the North Pacific to Japan on the west side of the North Pacific.

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